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AF/1745

PATENT APPLICATION

ATTORNEY DOCKET NO. 10014405-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Liu et al.

Confirmation No.:

Application No.: 10/061,830

Examiner: Yuan

Filing Date: Jan 31, 2002

Group Art Unit: 1745

Title: Fuel Cells And Drop Producing Devices That May Be Used With Fuel Cells

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on **June 17, 2005**.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( )	one month	$120.00
( )	two months	$450.00
( )	three months	$1020.00
( )	four months	$1590.00

( ) The extension fee has already been filled in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **08-2025** the sum of **$500.00**. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Signature: _____

Respectfully submitted,

Liu et al.

By _____

Craig A. Slavin

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PATENT

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Craig A. Slavin

Applicant: Liu
Serial No.: 10/061,830
Filing Date: 01/31/02
Title: Fuel Cell With Fuel Droplet Fuel Supply
Group Art Unit: 1745
Examiner: Yuan

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Mail Stop Appeal Brief - Patents

APPEAL BRIEF

I. REAL PARTY IN INTEREST

The real party in interest in the present appeal is Hewlett-Packard Development Company, LP, the assignee of the present application.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the Board's decision in the present appeal.

III. STATUS OF CLAIMS

Claims 1-9, 11-17, 20 and 82-89 are pending, have been rejected, and are set forth in the Appendix. Claims 10, 18, 19, 21-81 and 90-97 have been canceled. No claims have been allowed.

Applicant hereby appeals the rejections of claims 1-9, 11-17, 20 and 82-89.

IV. STATUS OF AMENDMENTS

No amendments were filed subsequent to the final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A. Independent Claim 1

Independent claim 1 is directed to a fuel cell system. Referring to FIGS. 1 and 3, formal versions of which are reproduced below, one example of the claimed system comprises "a fuel cell stack [104] including a plurality of anodes." [Spec. at page 4, lines 18-21.] The anodes, which are part of fuel cells 102, are identified by the word "anode" in FIG. 1 and reference character 106 in FIG. 3. Claim 1 also calls for "a ***single*** fuel supply apparatus [118] that supplies a plurality of fuel droplets [120] to ***each*** of the anodes." [Spec. at page 5, lines 6-10.]

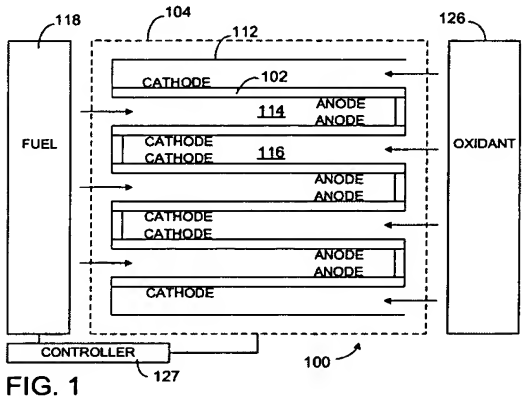

FIG. 1

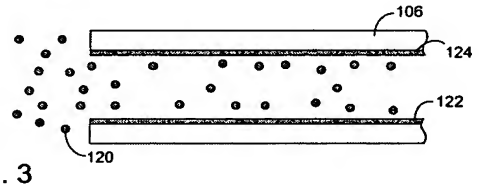

FIG. 3

B. Independent Claim 4

Independent claim 4 is directed to a fuel cell system. Examples of the claimed system, which comprises "a fuel cell [102] including at least one anode" and "a ***thermal*** drop ejector [128] that supplies a plurality of fuel droplets [120] to the at least one anode," are illustrated in FIGS. 4, 7 and 8. [Spec. at page 4, lines 18-21; page 7, lines 9-21; and page 7, line 31 to page 8, line 9.]

C. Independent Claim 5

Independent claim 5 is directed to a fuel cell system. One example of the claimed system, which comprises "a fuel cell [102] including at least one anode" and "a ***piezoelectric*** drop ejector [152] that supplies a plurality of fuel droplets [120] to the at least one anode," is illustrated in FIG. 9. [Spec. at page 4, lines 18-21; and page 8, lines 10-18.]

D. Independent Claim 6

Independent claim 6 is directed to a fuel cell system. One example of the claimed system, which comprises "a fuel cell [102] including at least one anode" and "a ***flextensional*** drop ejector [172] that supplies a plurality of fuel droplets [120] to the at least one anode," is illustrated in FIG. 13. [Spec. at page 4, lines 18-21 and page 9, lines 3-12.]

E. Independent Claim 8

Independent claim 8 is directed to a fuel cell system. Referring to FIGS. 1 and 3, which are reproduced on page 2 of this Brief, one example of the claimed system comprises "a fuel cell stack [104] including at least one anode pair arranged such that the ***anodes within the anode pair face one another and define a fuel passage [114] therebetween that extends from one anode in the pair to the other anode in the pair***." [Spec. at page 4, lines 23-28.] The claimed system further comprises "fuel supply means [118] for supplying a plurality of droplets [120] to the fuel passage [114] between the at least one anode pair." [Spec. at page 5, lines 6-12.] The present application discloses a wide variety of ***additional*** structures for performing the claimed function. More specifically:

1. The fuel supply apparatus 118a illustrated in FIG. 4, which includes a thermal drop ejector 128, a manifold 146, and a fan 148, performs the claimed function. [Spec. at page 7, lines 9-21.]

2. The fuel supply apparatus 118b illustrated in FIG. 7, which includes a thermal drop ejector 128 and a fan 148, performs the claimed function. [Spec. at page 7, line 31 to page 8, line 2.]

3. The fuel supply apparatus 118c illustrated in FIG. 8, which includes a plurality of thermal drop ejectors 128, performs the claimed function. [Spec. at page 8, lines 3-9.]

4. The fuel supply apparatus 118d illustrated in FIG. 9, which includes a plurality of piezoelectric drop ejectors 152, performs the claimed function. [Spec. at page 8, lines 10-18.]

5. The fuel supply apparatus 118e illustrated in FIG. 13, which includes a plurality of flextensional drop ejectors 172, performs the claimed function. [Spec. at page 9, lines 2-12.]

6. The fuel supply apparatus 118f, which may include an ultrasonic atomizer 194 and fan arrangement (FIG. 19) or an ultrasonic atomizer 198 (FIG. 20) which need not be used in conjunction with a fan, performs the claimed function. [Spec. at page 10, line 25 to page 11, line 9.]

F. Independent Claim 11

Independent claim 11 is directed to a fuel cell system. Referring to FIG. 4, a formal version of which is reproduced below, one example of the claimed system comprises "a fuel cell stack [104] including a plurality of anodes pairs arranged such that the ***anodes within each anode pair face one another and define a fuel passage [114] therebetween that extends from one anode in the pair to the other anode in the pair***, and a plurality of cathodes." [Spec. at page 4, lines 18-28.] The combination defined by claim 11 further comprises "a fuel reservoir [142]" and "a fuel supply apparatus [118a] that draws fuel from the fuel reservoir and supplies a plurality of fuel droplets [120] to the fuel passages [114]." [Spec. at page 7, lines 9-21.]

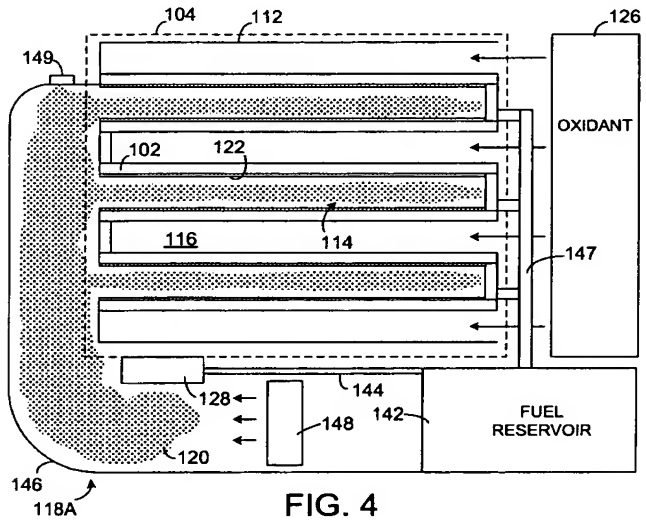

FIG. 4

G. Independent Claim 14

Independent claim 14 is directed to a method of operating a fuel cell stack. Referring for example to FIG. 3, a formal version of which is reproduced below, the claimed method comprises the steps of "directing a spray of fuel droplets [120] into ***a fuel passage [114] that extends from a first anode [106] in an anode pair to a second anode in the anode pair*** such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode" and "consuming the fuel at the anodes." In the illustrated example, the droplets 120 that come to rest on the anodes 106 form fuel layers 122 on anode surfaces 124. [Spec. at page 5, lines 3-10 and 21-22.]

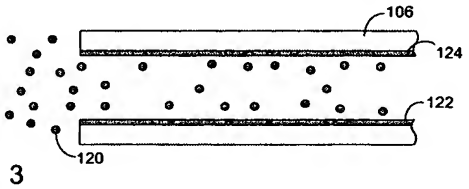

FIG. 3

H. Independent Claim 16

Independent claim 16 is directed to a method of operating a fuel cell having an anode. Referring for example to FIG. 3 above and to FIG. 7, a formal version of which is reproduced below, the claimed method comprises the steps of "directing a spray of fuel droplets [120] onto the anode by generating a spray of fuel droplets and blowing the droplets towards the anode ***with a fan*** [148]" and "consuming the fuel at the anode." [Spec. at page 5, lines 3-10 and 21-22; and page 7, line 31 to page 8, line 2.]

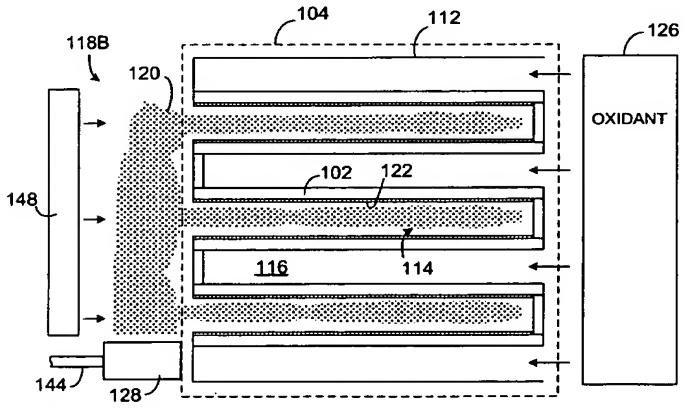

FIG. 7

I. Independent Claim 20

Independent claim 20 is directed to a fuel supply system for use with a fuel cell including an anode. Referring to FIG. 4, which is reproduced on page 4 of this Brief, one example of the claimed system comprises "a fuel reservoir [142] that stores fuel" and "fuel supply means [118a], operably connected to the fuel reservoir, for supplying a plurality of droplets [120] to the at least one anode." [Spec. at page 6, lines 4-7 and page 7, lines 9-21.] The other exemplary structures disclosed in the present application for performing the function recited in the means-plus-function element are discussed in Section V-E above. The claimed system further comprises "a controller adapted to monitor a rate of fuel consumption at the anode and to control the fuel supply means to supply droplets ***at a rate that results in a fuel layer being maintained on the anode***." [Note reference character 127 in FIG. 1; and spec. at page 5, lines 17-28.]

J. Independent Claim 82

Independent claim 82 is directed to a fuel cell system. Referring for example to FIGS. 1 and 3, which are reproduced on page 2 of this Brief, one example of the claimed system comprises "a fuel cell [102] including at least one anode [106] defining a surface [124] that receives fuel and a fuel passage [114] adjacent to the anode surface that receives fuel" and "a fuel supply apparatus [118] that directs a plurality of fuel droplets [120] into the fuel passage in a ***direction that is non-perpendicular*** to the anode surface that receives fuel." [Spec. at page 4, lines 18-28 and page 5, lines 6-10.] One of the other examples of the invention defined by independent claim 82 is discussed in greater detail below in the context of the objection under 35 U.S.C. § 132 and rejection of dependent claim 83 under 35 U.S.C. § 112, first paragraph.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Objection Under 35 U.S.C. § 132 and Rejection Under Section 112

The amendment filed January 11, 2005 has been objected to under 35 U.S.C. § 132 for purportedly introducing new matter into the specification. [Office Action at page 1.] Claim 83 has been rejected under 35 U.S.C. § 112, first paragraph, as purportedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the art that the inventor(s), at the time the application was filed, has possession of the invention. [Office Action at page 2.] More specifically, the objection and rejection both relate to the recitation in claim 83 that "the fuel supply apparatus directs a plurality of droplets into the fuel passage in a direction that is ***substantially parallel*** to the anode surface that receives fuel."

B. Rejection Under 35 U.S.C. § 102

Claims 1-3, 7, 8, 11-15, 17, 20, 82, 84, 85 and 89 have been rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 6,440,594 to Kindler ("the Kindler '594 patent"). On pages 2-4, the Office Action stated:

> With respect to claims 1,3,8,11,14,85, Kindler et al. teach a direct oxidation fuel cell system comprising a plurality of anodes, a plurality of cathodes, a plurality of electrolyte and a fuel reservoir. The fuel is provided in the form of an aerosol of liquid fuel droplets suspended in a gas. The aerosol is formed in a single aerosol generator situated within the anode chamber of the fuel cell. Figure 6 is a schematic representation of a preferred fuel cell system incorporating a stack of individual membrane electrode assemblies. The fuel cell is formed by joining a plurality of anode biplates (602) and a plurality of cathode biplates (604), wherein the anode biplate (602) has an internal surface comprising a flowfield element (610) and an atomizer. The anode pair is interpreted as the series of the anode bipolar plates (602) as shown in Figure 6, wherein fuel is distributed between at least one anode pair along the fuel passage therebetween. Kindler et al. further teach the fuel cell system comprising an aerosol generator (21) (a single fuel supply apparatus), which comprises a plurality of atomizers (25) that form an aerosol of liquid fuel droplets suspended in the anode. Alternatively, the pump (20) or the can be considered as the

single fuel supply apparatus. See Abstract; Column 1, Line 64 to Column 2, Line 11; Column 3, Lines 29-34; Column 5, Lines 27-47; Column 15, Line 57 to Column 16, Line 21; Figure 6.

With respect to claim 2,13,17,20,84, the amount of aerosol fuel delivered to the anode depends upon the particular oxidation catalyst used in the anode, the permeability of the membrane in the electrode assembly to liquid fuel, the fuel concentration in the aerosol droplets, and the temperature and pressure within the cell. By monitoring fuel cell operating characteristics it is possible to determine an optimum aerosol feed rate for a give fuel cell configuration and cell operating conditions. For example, monitoring fuel cell power output, cell potential, or operating current provides convenient measures of fuel cell operating performance suitable for use in controlling the rate of aerosol fuel delivery to the anode. Preferably, the fuel droplet delivery rate is controlled by varying the duty cycle of the aerosol generator to maintain a desired cell output potential at a given power output. See Column 7, Lines 31-67. Kindler et al. do not specifically disclose the presence of a controller in the fuel cell system. However, it is the position of the examiner that such controller is inherent, given that both Kindler et al. and the present application utilize similar operation procedure and control sequence to operate the direct oxidation fuel cell system. Also, a controller would be essential to monitor and regulate the fuel droplet delivery rate into the fuel passage. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 7,12,15,89, Kindler et al. further teach any number of means for forming an aerosol may be employed. For example, an aerosol may be formed by heat the fuel to a temperature above its boiling point in the presence of the suspending gas, then rapidly cooling the superheated fuel vapor to nucleate condensed droplets of liquid fuel suspended in the gas. The aerosol is preferably formed by atomizing the liquid fuel into the suspending gas. A wide variety of atomization means are known to those skilled in the art and may be employed in this invention. These include orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas-assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency to form liquid droplets in a suspending gas. See Column 7, Lines 14-30.

With respect to claim 11, Kindler further teaches the use of a methanol reservoir to provide the fuel. See Figure 1.

With respect to claim 14, Kindler further teaches the fuel droplets rest on either surfaces of the anode biplate. See Figure 4, Column 13, Lines 46-65.

With respect to claim 82, Kindler et al. teach the aerosol generator directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode biplate as evidenced in the disclosures of Figures 4 and 6.

C. Rejections Under 35 U.S.C. § 103

Claims 4-6 and 86-88 have been rejected under 35 U.S.C. § 103 as being unpatentable over the Kindler '594 patent. On pages 5 and 6, the Office Action stated:

> Kindler et al. disclose a fuel cell system comprising an ultrasonic atomizer as the fuel supply apparatus as described above in Paragraph 6. However, Kindler et al. do not specifically disclose the use a thermal drop ejector, a piezoelectric drop ejector, or a flextensional drop ejector to produce the fuel droplets into the fuel passage. Nevertheless, Kindler et al. disclose the amount of fuel delivered to the anode may be manipulated by adjusting the atomization conditions; for example, liquid feed rate, nozzle pressure, rotational speed of the disk, or oscillation frequency or power for an ultrasonic nozzle. Such methods are well known to those skilled in the art. Alternatively, the atomizer may be operated in a discontinuous manner, for example, by pulsing the liquid feed to the atomizer or pulsing the delivery of liquid fuel droplets from the atomizer. For example, the atomizing gas (for a two fluid atomization nozzle), rotational means (for a rotary nozzle) or oscillation means (for an ultrasonic nozzle) may be turned on or off alternately in a pulsed manner in order to maintain the desired fuel droplet delivery rate as reflected by the measured cell output potential and power output. Moreover, each in situ atomizer 612 may be selected from a wide variety of atomization means, including orifices, single fluid atomization nozzles (airless sprayers), two fluid atomization nozzles (gas assisted sprayers), rotating discs or wheels onto which the liquid is fed, or ultrasonic nozzles in which liquid is feed onto a needle or orifice oscillated at very high frequency (typically ≥ 20 kHz) to form liquid droplets in a suspending gas. See Column 7, Lines 14-61; Column 15, Line 66 to Column 16, Line 10. Kindler reference teaches the delivery of droplet fuel using various means is well known to those skilled in the art. Therefore, it would have been obvious to one of ordinary skill in the art to substitute a thermal drop ejector (or a piezoelectric drop ejector, or a flextensional drop ejector) for the ultrasonic atomizer as the fuel droplet generating means in the fuel cell system disclosed by Kindler, because they are considered functionally equivalent fuel delivering means.

Claim 9 has been rejected under 35 U.S.C. § 103 as being unpatentable over the combined teachings of the Kindler '594 patent and U.S. Patent No. 6,572,993 to Singh et al. ("the Singh '993 patent"). On page 6, the Office Action stated:

> Kindler et al. disclose a fuel cell system as described above in Paragraph 6. However, Kindler et al. do not disclose that the fuel cell system further comprising storage means for storing energy generated by the system. Singh et a!. teach an electrical storage device is coupled in parallel to a fuel cell power generation system. The electrical storage device is either a battery pack, a plurality of capacitors, or a plurality of supercapacitors. The electrical storage device is capable of minimizing the unreacted fuel within the anode chamber. See Abstract, Column 1, Lines 40-64; Column 2, Lines 3-29. Therefore, it would have been obvious to one of ordinary skill in the art to coupled an electrical storage device to the fuel cell system of Kindler et al. in parallel, because Singh et al. teach the use of either a battery pack, capacitors or supercapacitors to reduce the amount of excess fuel during transient operating conditions.

Claim 16 has been rejected under 35 U.S.C. § 103 as being unpatentable over the combined teachings of the Kindler '594 patent and U.S. Patent No. 6,152,382 to Pun ("the Pun '382 patent"). On page 7, the Office Action stated:

> Kindler et al. disclose a method of operating a fuel cell as described above in Paragraph 6. However, Kindler et al. do not disclose the use of a fan in blowing the droplets towards the anode. Pun teaches that fans and blowers are required to project the atomized droplets to intended targets. See Column 1, Lines 22-25. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a fan on the method of operating a fuel cell of Kindler et a!., because Pun teaches the use of a fan to help project the atomized droplets to the intended targets (anode plates) in the fuel cell system.

VII. ARGUMENTS

A. Objection and Rejection Under 35 U.S.C. §§ 132 and 112

The Office Action has apparently taken the position that the application as filed does not support a "fuel supply apparatus [that] directs a plurality of droplets into the fuel passage in a direction that is ***substantially parallel*** to the anode surface that receives fuel," as is called for dependent claim 83. Applicant respectfully

submits that, contrary to assertion in the Office Action, the invention defined by claim 83 is clearly supported by the application as filed.[1]

The present application includes a number of exemplary embodiments in which the fuel droplets are directed into fuel passages in a direction that is substantially parallel to the anode surface that receives fuel. Referring first to FIG. 1, a formal version of which is reproduced below, the application indicates that the anodes have surfaces which receive fuel. The application also clearly indicates that there are fuel passages 114 adjacent to the anode surfaces that receive fuel and that fuel droplets can be supplied by a variety of fuel supply apparatus 118. [See, for example, the Spec. at page 5, lines 6-10.] The ***arrows in Figure 1 clearly indicate*** that fuel is directed into the fuel passages 114 in a direction that is ***substantially parallel*** to the surfaces of the anodes that receive fuel.

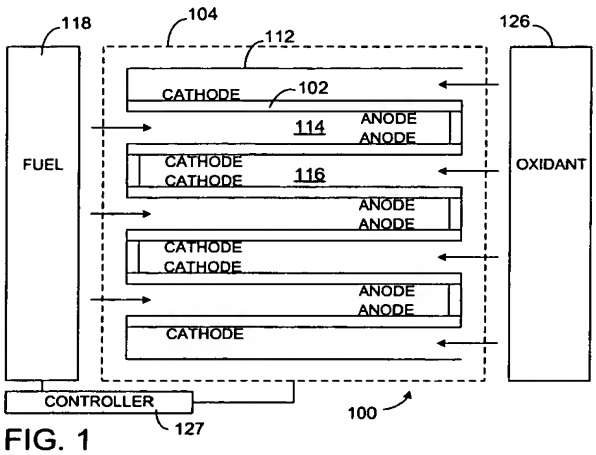

FIG. 1

The present application also discloses a variety of other fuel supply apparatus which supply droplets in the manner described above. One example of such an apparatus is the fuel supply apparatus 118e illustrated in FIGS. 13-18. As illustrated

[1] The discussion below make reference to, *inter alia*, FIGS. 1 and 18 of the present application. The Brief Description of the Drawings section of the application indicates that these drawings are "diagrammatic." The word "diagrammatic" means "[a] plan, sketch, drawing, or outline designed to ***demonstrate or explain how something works or to clarify the relationship between the parts of a whole.***" *The American Heritage® Dictionary of the English Language, Fourth Ed. (2000)*, emphasis added. In claim 83, applicant is defining the manner in which one of the present inventions works and relationship between the parts of that invention.

for example in FIGS. 16 and 18, formal versions of which are reproduced below, the exemplary fuel supply apparatus 118e includes flextensional drop ejectors 172 with a plurality of nozzles 186. The specification indicates that "the use of flextensional drop ejectors allows fuel to be fired into the passages 114 in a variety of ways." [Spec. at page 9, lines 10-12.] To that end, the flextensional drop ejectors 172 may be operated in a number of firing modes.

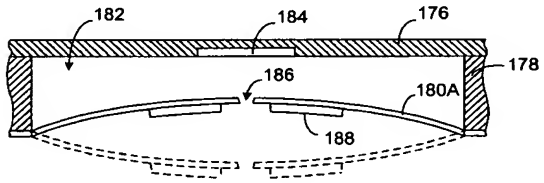

FIG. 16

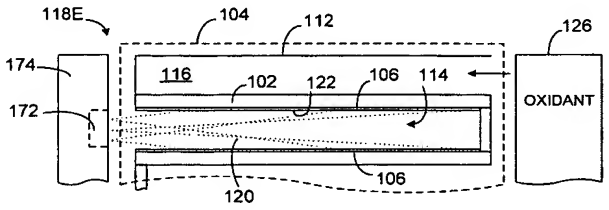

FIG. 18

In the ***first firing mode***, which is illustrated in FIG. 16, the fuel droplets ejected by the drop ejectors 172 "travel in a direction that is generally perpendicular to the plane defined by the outermost portion of the nozzle (i.e. straight out of the nozzle)." [Specification at page 9, line 31 to page 10, line 1.] As clearly illustrated in FIGS. 16 and 18, the direction that is perpendicular to the plane defined by the outmost portion of the nozzle 186 is ***substantially parallel*** to the surface of the anode 106 that receives fuel. [Note that the droplets 120 actually shown in FIG. 18 are traveling in a direction defined by the second firing mode, which is discussed below.]

The specification also indicates that "such an arrangement may be used to fire a plurality of droplets straight into the fuel passages 114." [Specification at page 10, lines 1-3.] Given the relative positions of the drop ejector 172 and the anode 106 "diagrammatically" illustrated in Figure 18, applicant respectfully submits that one of skill in the art would recognize that droplets fired straight out of the drop ejector nozzles 186 into the fuel passage 114 would be fired in a direction that is ***substantially parallel*** to the surface of the anode 106 that receives fuel.

The fact that the fuel supply apparatus 118e "directs a plurality of droplets into the fuel passage in a direction that is substantially parallel to the anode surface that receives fuel" in the first firing mode is further emphasized by the portion of the specification that describes the second firing mode. ***In the second firing mode***, the drops are ***not*** fired in a direction that is substantially parallel to the anode surface.

Instead, the drop ejectors 172 "fire fuel droplets toward the surface of each anode 106 in the manner illustrated for example in Figure 18." [FIG. 17 and Spec. at page 10, lines 9-13.]

In view of the foregoing, and although the application as filed did not include the exact phrase "a fuel supply apparatus that directs a plurality of fuel droplets into the fuel passage in a direction that is substantially parallel to the anode surface that receives fuel," applicant respectfully submits that such a fuel supply apparatus was clearly illustrated and described in a manner that satisfies the requirements of 35 U.S.C. §§ 112 and 132.[2] The rejection and objection under 35 U.S.C. §§ 112 and 132 are, therefore, improper and should be reversed.

B. The Rejection Under 35 U.S.C. § 102

1. The Legal Standards

With respect to claim interpretation, the recent *en banc* Federal Circuit decision in *Phillips v. AWH Corp.*, ____ USPQ2d _____, (Fed. Cir. 2005), indicated that "[t]he Patent and Trademark Office ("PTO") determines the scope of the claims in patent applications not solely on the basis of the claim language, but upon giving the claims their broadest reasonable construction 'in light of the specification as it would be interpreted by one of ordinary skill in the art.'" *Citing In re American Academy of Science Technology Center*, 70 USPQ2d 1827, (Fed. Cir. 2004)."

Once the claim is interpreted, "[a] rejection for anticipation under section 102 requires that ***each and every*** limitation of the claimed invention be disclosed in a single prior art reference. In addition, the reference must be enabling and describe the applicant's claimed invention sufficiently to have placed it in possession of a person of

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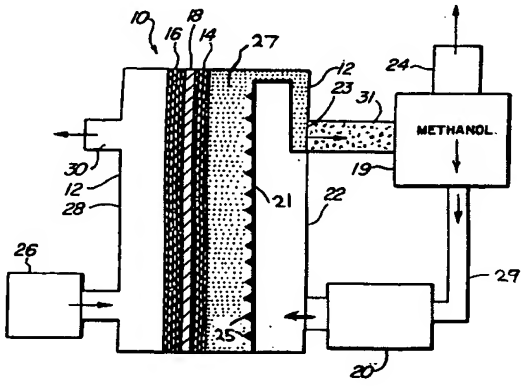
[2] Applicant respectfully notes that the "claimed subject matter need not be described *in haec verba* in the specification in order for that specification to satisfy the description requirement." *In re Smith and Hubin*, 178 USPQ 620, 624 (CCPA 1973). Rather, applicant need only convey to those skilled in the art that, as of the filing date sought, he or she was in possession of the claimed invention. "One does that by such descriptive means as words, structures, figures, diagrams, formulas, etc., that fully set forth the claimed invention." *Lockwood v. American Airlines, Inc.*, 41 USPQ2d 1961, 1966 (Fed. Cir. 1997).

ordinary skill in the field of the invention." *In re Paulsen*, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994) (citations omitted). With respect to claim elements in means-plus-function form, the MPEP specifically states that "the application of a prior art reference to a means or step plus function limitation requires that the prior art element perform the ***identical function*** specified in the claim." MPEP § 2182, emphasis added. Along these lines, the Federal Circuit stated that "[t]he corresponding structure to a function set forth in a means-plus-function limitation ***must actually perform the recited function, not merely enable the pertinent structure to operate as intended.***" *Asyst Technologies Inc. v. Empak Inc.*, 60 USPQ2d 1567, 1672-73 (Fed. Cir. 2001), emphasis added.

2. The Kindler '594 Patent

The Kindler '594 patent discloses a number of aerosol feed fuel cell configurations. Referring to FIG. 1, which is reproduced below, one of the aerosol feed fuel cell configuration includes membrane electrode assembly (i.e. an anode 14 and cathode 16 separated by an electrolyte membrane 18), a pump 20, and an aerosol generator 21 within an anode chamber 22. [Column 5, lines 27-39.] The aerosol generator 21, which receives fuel from the pump 20, includes a plurality of atomizers 25 that fire fuel droplets 27 at the anode 14. In other words, a single aerosol generator 21 fires fuel droplets 27 at a single anode 14 in a direction that is perpendicular to the anode surface.

FIG. 1



The Kindler '594 patent also includes a discussion concerning fuel cell stacks that include biplates. [Column 14, line 63 to column 15, line 56.] As known to those of

skill in the art, and as explained in the Kindler '594 patent, such a stack includes a plurality of membrane electrode assemblies (i.e. an anode and a cathode separated by an electrolyte membrane) with conductive biplates between adjacent membrane electrode assemblies. The Kindler '594 patent also indicates that the fuel cell stacks include endplates at the ends of the stack, one of which includes an anode and the other of which includes a cathode. [Column 15, lines 41-47.]

In the context of FIG. 6, which is reproduced on the following page, the Kindler '594 patent indicates that a preferred aerosol feed fuel cell configuration includes a plurality of stacked membrane electrode assemblies. [Column 15, lines 57-59.] The membrane electrode assemblies 608 include an anode assembly 602 and a cathode assembly 606 separated by an electrolyte membrane 604. [Column 15, lines 61-63.] It should be noted here that the Kindler '594 patent also uses the terms "anode biplate 602" and "cathode biplate 604." The use of the terms "anode biplate 602" and "cathode biplate 604" in place of the terms "anode assembly 602" and "cathode assembly 606" appears to be a typographical error because it conflicts with the preceding discussion concerning anodes, cathodes, biplates and endplates in column 14, line 63 to column 15, line 56 of the Kindler '594 patent.[3] More specifically, as discussed in the Kindler '594 patent and as known to those of skill in the art, a biplate (sometimes referred to as a "bipolar" plate) is an electrically conductive device that separates the anode in one membrane electrode assembly (or endplate) from the cathode in an adjacent membrane electrode assembly (or endplate). Accordingly, the present discussion uses the terms "anode assembly 602" and "cathode assembly 606." Should the examiner disagree with this position, applicant hereby requests that the Examiner do so explicitly (and provide justification) so that applicant can respond in a Reply Brief.

[3] Applicant's undersigned representative was also unable to find a single instance of the use of the term "anode biplate," other than its use in column 15, line 60 to column 17, line 1 of the Kindler '594 patent, despite searching for the term "anode biplate" in the Yahoo® search engine, the Google® search engine, the USPTO web site (patents and published applications), and the Delphion® search engine (EPO applications and patents, PCT publications, Japanese abstracts, and German patents and published applications - for collection details see http://www.delphion.com/collect_descrip#EPA).

Turning to manner in which fuel is supplied to the anodes in the aerosol feed fuel cell configuration discussed in the context of FIG. 6, which is reproduced below (poor drawing quality in original), the Kindler '594 patent indicates that each anode assembly 602 has "an internal surface comprising a flowfield element 610 and an aerosol generator." [Column 15, lines 63-65.] With respect to the configuration of the "aerosol generator," the Kindler '594 patent indicates that the aerosol generator illustrated in FIG. 6 includes "a plurality of individual in situ atomizers, each atomizer 612 situated at the internal surface of the anode [assembly] 602 so as to atomize liquid fuel droplets into the anode chamber 616." [Column 15, line 66 to column 16, line 2.]

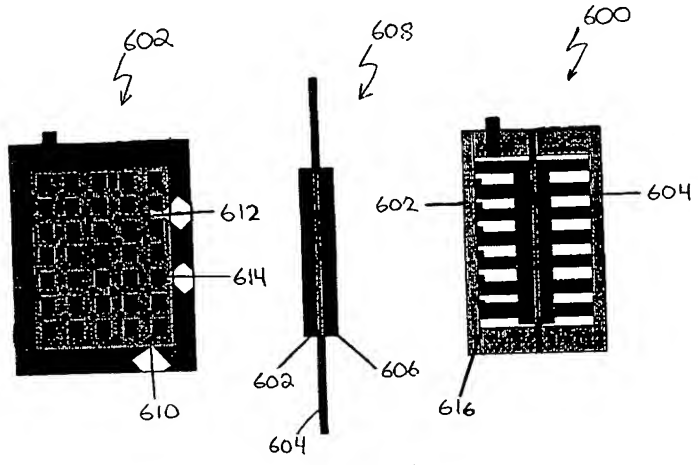


Fig. 6

3. Arguments Concerning Claims 1-3 and 7

Independent claim 1 calls for a combination of elements comprising "a fuel cell stack including a ***plurality of anodes***" and "a ***single fuel supply apparatus*** that ***supplies a plurality of fuel droplets to each of the anodes***." The respective combinations defined by dependent claims 2, 3 and 7 include, *inter alia*, the elements recited in claim 1.

The Kindler '594 patent fails to teach or suggest such combinations. For example, the aerosol feed fuel cell configuration illustrated in FIG. 1 includes a ***single "fuel supply apparatus"*** (the aerosol generator 21) that supplies fuel droplets to a ***single anode*** 14, not to a plurality of anodes as called for in independent claim 1. In response to this argument concerning the configuration illustrated in FIG. 1, which applicant has made previously, the Office Action correctly states that the aerosol

generator 21 "further comprises a plurality of atomizers (25), which form an aerosol of liquid fuel droplets." [Office Action at pages 8.] The statement appears to imply that each atomizer 25 is itself "a fuel supply apparatus," as this term is used in claim 1. Even assuming *arguendo* that this is a reasonable interpretation of claim 1, this interpretation results in the Kindler '594 patent disclosing a ***plurality*** of "fuel supply apparatus" (the atomizers 25) that are together supplying fuel droplets to a ***single*** anode (the anode 14), which is the ***opposite*** of this aspect of the claimed combination, which calls for a plurality of anodes and a single fuel supply apparatus.

In further response to applicant's argument, the Office Action states that, alternatively, the pump 20 "can be considered as the single fuel supply apparatus." [Office Action at page 3.] This alternate claim interpretation is defective for at least two reasons. First, in the context of the fuel cell configuration illustrated in FIG. 1 of the Kindler '594 patent there is only one anode 14. [FIG. 6 is discussed below.] Thus, the pump 20 is only supplying fuel to a single anode, not a plurality of anodes. More importantly, however, is the fact the alternate claim interpretation is completely unreasonable. The "fuel supply apparatus" recited in claim 1 "supplies a plurality of fuel droplets" to anodes. The Kindler pump 20, on the other hand, does not supply droplets to anodes. Nor does it supply droplets to anything else. The pump 20 supplies liquid fuel to the aerosol generator 21, and the aerosol generator 21 supplies the droplets to the anode 14.[4]

The Kindler '594 patent also describes a number of other instances where only one fuel cell (i.e. ***one anode***) is present. More specifically, the Kindler '594 patent indicates that aerosol may be "formed in an aerosol generator situated within the anode chamber of the fuel ***cell***," "formed in an aerosol generator external to the anode chamber of the fuel ***cell*** and fed to the anode chamber via a duct," or "formed externally to the anode chamber of the fuel ***cell***, fed to a particle size conditioner situated between the aerosol generator and the anode chamber, and subsequently fed to the anode chamber via a duct." [Column 2, lines 10-42.] Here too,

[4] Applicant also notes for the record that the Office Action's "alternate" interpretation is inconsistent with the present specification. On page 7, lines 9-16, the specification makes it perfectly clear that a "pump" is not a "fuel supply apparatus that supplies a plurality of fuel droplets." Rather, a "pump" is a device that may be used to transfer fuel from a fuel reservoir to a "fuel supply apparatus."

independent claim 1 cannot be anticipated by the Kindler '594 patent because claim 1 calls for a plurality of anodes.

Finally, the fuel cell configuration discussed in the context of FIG. 6 includes a plurality of stacked membrane electrode assemblies and, accordingly, is the one instance in the Kindler '594 patent where a plurality of anode assemblies 602 are present. In contrast to the invention defined by claim 1, however, each anode assembly 602 includes ***its own*** aerosol generator. More specifically, each anode assembly 602 includes a plurality of in situ atomizers 612. [Column 15, lines 57 to column 16, line 14.] Even the Office Action states that "the aerosol is formed in a single aerosol generator situated within the anode." [Office Action at page 2.] In other words, each anode assembly 602 has its own built-in apparatus for supplying fuel droplets to the associated anode and, to the extent that there is a plurality of anodes in the stack, that there is a corresponding plurality of aerosol generators (i.e. one for each anode). There simply is no "***single*** fuel supply apparatus that supplies a plurality of fuel droplets to ***each of [a plurality of] anodes***," as called for in independent claim 1. Even assuming for the sake of argument that the fuel cell configuration illustrated in FIG. 6 includes a pump, such as the pump 20 illustrated in FIG. 1, the pump would be merely supplying fuel to the individual aerosol generators (i.e. the in situ atomizers 612), which in turn supply fuel droplets to the associated anodes.

As the Kindler '594 patent fails to teach or suggest each and every element of the combination recited in independent claim 1, applicant respectfully submits that the rejection of claims 1-3 and 7 under 35 U.S.C. § 102 should be reversed.

4. Arguments Concerning Claims 8 and 11-13

Independent claim 8 calls for a combination of elements comprising "a fuel cell stack including at least one anode pair arranged such that ***the anodes within the anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair***" and "fuel supply means for supplying a plurality of droplets to the fuel passage between the at least one anode pair."

Similarly, independent claim 11 calls for a combination of elements comprising "a plurality of anodes pairs arranged such that the ***anodes within each anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair***" and "a fuel supply apparatus that draws fuel from the fuel reservoir and supplies a plurality of fuel droplets to the fuel passages." The respective combinations defined by dependent claims 12 and 13 include, *inter alia*, the elements recited in claim 11.

The Kindler '594 patent fails to teach or suggest such combinations. As noted above, the only fuel cell configuration disclosed in the Kindler '594 patent that includes more than one anode is the fuel cell stack discussed in the context of FIG. 6. This fuel cell stack includes a plurality of membrane electrode assemblies (i.e. an anode assembly 602 and a cathode assembly 606 separated by an electrolyte membrane 604) with conductive biplates between adjacent membrane electrode assemblies. In other words, ***between any two anodes in a purported Kindler "anode pair," there is an electrolyte membrane 604, a cathode assembly 606, and a biplate***. The Office Action has taken the position that "[t]he anode pair is interpreted as the series of the anode bipolar plates (602) as shown in Figure 6, wherein fuel is distributed between at least one anode pair along the fuel passage therebetween." [Office Action at page 10.] Applicant respectfully submits that there is no reasonable interpretation of independent claims 8 and 11 that would read on a structure, such as that disclosed in the Kindler '594 patent, where there is an electrolyte membrane, a cathode, and a biplate between the anodes in the purported "pair." Applicant also notes for the record that only one anode assembly 602 is actually shown in FIG. 6.

Even when impermissibly viewed in a vacuum, the language of independent claims 8 and 11 precludes the interpretation presented in the Office Action. Claims 8 and 11 require that the "anodes within the [or each] anode pair face one another." The anode assemblies 602 in a stack such as that disclosed in Kindler '594 patent face in the same direction, i.e. all facing up or all facing down. They do not face one another. Claims 8 and 11 also indicate that the "fuel passage" between the anodes in the pair "extends from one anode in the pair to the other anode in the pair." Even assuming for the sake of argument that the space between the in situ atomizers 612 and the anode electrode in each anode assembly 602 is a "fuel passage," the "fuel

passage" does not extend though the electrolyte membrane 604, the cathode assembly 606 and the biplate. A fuel passage is, by definition, a place through which fuel passes. There is no fuel in the electrolyte membrane 604, there is no fuel in the cathode assembly 606, and there is no fuel in the biplate. Moreover, under the interpretation presented in the Office Action, the purported "fuel passage" would subsume the "passage" of the Kindler fuel cell configuration though which oxidant passes.

Turning to the specification of the present application, the specification indicates in no uncertain terms that a fuel cell arrangement with anodes facing one and a bipolar arrangement, such as that disclosed in the Kindler '594 patent, are two different things. More specifically, the specification states that "although the exemplary fuel cell stacks illustrated in Figures 1-19 have anodes facing one another, it should be noted that the inventions herein are applicable to the traditional bipolar configuration." [Spec. at page 4, lines 12-15.] Independent claim 1, for example, covers both bipolar configurations and configurations in which two anodes face one another.

As illustrated above, the Kindler '594 patent fails to teach or suggest each and every element of the respective combinations recited in independent claims 8 and 11. For example, the Kindler '594 patent fails to teach or suggest "anode pair arranged such that the anodes within the anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair." Applicant respectfully submits, therefore, that the rejection of claims 8 and 11-13 under 35 U.S.C. § 102 should be reversed.

5. Arguments Concerning Claims 14, 15 and 17

Independent claim 14 is directed to a "method of operating a fuel cell stack." The method includes, *inter alia*, the step of "directing a spray of fuel droplets into ***a fuel passage that extends from a first anode in an anode pair to a second anode in the anode pair*** such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode." The respective combinations defined by dependent claims 15 and 17 include, *inter*

alia, the steps recited in claim 14. The Kindler '594 patent fails to teach or suggest such combinations.

As discussed in greater detail in the preceding section of this Brief, the fuel cell stack discussed in the context of FIG. 6 of the Kindler '594 patent includes a plurality of membrane electrode assemblies and conductive biplates between adjacent membrane electrode assemblies. There is ***an electrolyte membrane 604, a cathode assembly 606, and a biplate*** between any two anode assemblies 602 in the purported Kindler "pair" and, accordingly, there simply is no fuel passage that extends from a first anode assembly 602 in an "anode pair" to a second anode assembly 602 in "the anode pair." So configured, the fuel cell stack disclosed in the Kindler '594 patent simply cannot perform the step of "directing a spray of fuel droplets into ***a fuel passage that extends from a first anode in an anode pair to a second anode in the anode pair*** such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode." Instead, each Kindler anode assembly 602 includes its own in situ atomizers 612 and those atomizers direct fuel droplets at a single anode (i.e. the anode in the associated anode assembly 602).

As the Kindler '594 patent fails to teach or suggest each and every step in the combination recited in independent claim 14, applicant respectfully submits that the rejection of claims 14, 15 and 17 under 35 U.S.C. § 102 should be reversed.

6. Arguments Concerning Claim 20

Independent claim 20 calls for a combination of elements including, *inter alia*, "a ***controller*** adapted to monitor a rate of fuel consumption at the anode and to ***control the fuel supply means to supply droplets at a rate that results in a fuel layer being maintained*** on the anode." The Kindler '594 patent fails to teach or suggest such a combination.

The Office Action has taken the position that although the Kindler '594 patent fails to specifically disclose a controller, a controller is inherent. [Office Action at page 3.] Even assuming *arguendo* that a controller is inherently disclosed by the Kindler '594 patent, claim 20 requires more than a controller *per se*. Claim 20 requires a controller that controls the "fuel supply means to supply droplets at a rate that results

in a ***fuel layer being maintained on the anode***." This aspect of the claimed combination is not disclosed explicitly or inherently in the Kindler '594 patent. The Kindler '594 patent does discuss varying the amount of fuel supplied to the anode. [Column 7, line 31-46.] It does not, however, appear to teach or suggest maintaining a layer of fuel on the anode. The Kindler '594 patent actually appears to ***teach away*** from the formation of a fuel layer. [Column 8, lines 18-29; and column 8, line 49 to column 9, line 50.]

Faced with this deficiency in the purportedly anticipatory reference, the Office Action has taken the somewhat unique position that, because the Kindler '594 patent "***does not explicitly exclude the possibility*** of forming a (discrete) fuel layer on the anode due to the coalescence of fuel droplets," the claimed subject matter in anticipated. [Office Action at page 10, emphasis added.] Applicant respectfully submits that "does not explicitly exclude the possibility of the claimed subject matter" is not the standard by which anticipation is determined. Rather, the proper inquiry is whether or not "***each and every limitation*** of the claimed invention be disclosed in a single prior art reference." *In re Paulsen*, 31 USPQ2d at 1673.

In view of the fact that the Office Action has not established that the Kindler '594 patent discloses at least one of the limitations recited in claim 20, the rejection of claim 20 under 35 U.S.C. § 102 is improper and should be reversed.

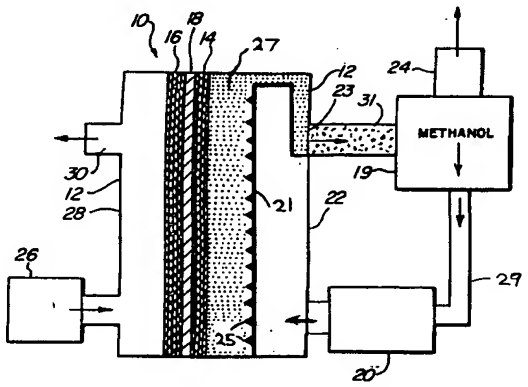
7. Arguments Concerning Claims 82, 84, 85 and 89

Independent claim 82 calls for a combination of elements comprising, *inter alia*, "a fuel cell including at least one anode defining a surface that receives fuel and a fuel passage adjacent to the anode surface that receives fuel" and "a fuel supply apparatus that ***directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode surface that receives fuel***." The respective combinations defined by dependent claims 84, 85 and 89 include, *inter alia*, the elements recited in claim 82. The Kindler '594 patent fails to teach or suggest such combinations.

Referring first to the fuel cell configuration illustrated in FIG. 1, which is reproduced on the following page, the Kindler '594 patent discloses an aerosol

generator 21 (with atomizers 25) that fires fuel droplets 27 at the anode 14 in a direction that is clearly ***perpendicular*** to the anode surface that is receiving the fuel.

FIG. 1



Turning to FIG. 4, which is reproduced below and referenced on page 4 of the Office Action, the Kindler '594 patent indicates that the anode 14 is provided with a porous catalyst on which the electro-oxidation reaction takes place. [Column 10, line 43 to column 11, line 4.] This multi-layer structure is visible in FIG. 1. The Kindler '594 patent also indicates that "FIG. 4 provides a schematic representation of an aerosol fuel feed being transported by diffusion ***within a pore*** having a diameter defined by the walls of a backing structure adhered to a catalyst layer to form an electrode." [Column 3, lines 20-23.] In FIG. 4, reference character 438 is pointing to a portion of catalyst layer and ***an individual pore 434 in the backing material 346*** is shown abutting the catalyst layer 438. [Column 13, lines 46-56.] The pore is clearly oriented such that it is perpendicular to the catalyst layer 438 and, accordingly, is perpendicular the rest of the anode. Thus, both before and after they enter the pore 434, the fuel droplets 432 are moving in a direction that is perpendicular to the anode, as is shown in FIG. 1.

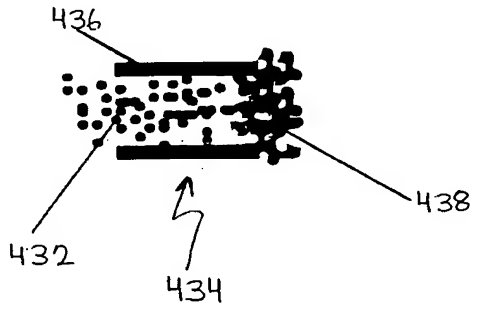


Fig. 4

With respect to the fuel cell configuration illustrated in FIG. 6, which is reproduced below, the Kindler '594 patent states:

> Each nozzle is an atomizer 612 and is situated at an intersection of at least two flow channels on the inner surface of the flow field element. The intersecting flow channels create islands 614. ***The outlet of each nozzle faces the anode side*** of the membrane electrode assembly 608. The aerosol fuel from each nozzle is preferably supplied directly against the surface of the membrane electrode at an island 614 formed by the intersecting flow channels.

[Column 16, lines 12-19.] In other words, to the extent that the anode chamber 616 within an anode assembly 602 is a "fuel passage," the atomizers 612 are firing the fuel droplets in a direction that is perpendicular to the anode surface, much like the arrangement illustrated in FIG. 1 of the Kindler '594 patent.

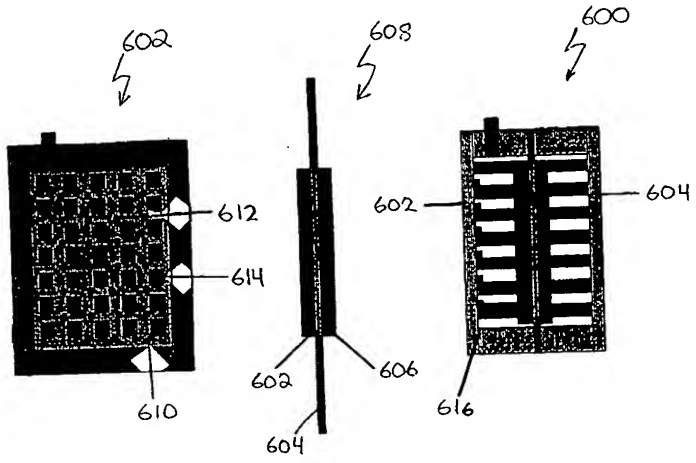


Fig. 6

As the Kindler '594 patent fails to teach or suggest each and every element in the combination recited in independent claim 82, applicant respectfully submits that the rejection of claims 82, 84, 85 and 89 under 35 U.S.C. § 102 should be reversed.

C. Rejections Under 35 U.S.C. § 103

1. The Legal Standards

With respect to the legal standard upon which patentability under 35 U.S.C. § 103 is evaluated, *In re Kotzab*, 55 USPQ2d 1313, 1316-17 (Fed. Cir. 2000), provides a fairly succinct summary of the standard adhered to by the Federal Circuit:

> A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." Most if not all inventions arise from a combination of old elements. Thus, every element of a claimed invention may often be found in the prior art. However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there ***must be some motivation, suggestion or teaching*** of the desirability of making the specific combination that was made by the applicant. ***Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference.***

[Citations emitted, emphasis added.] The *Kotzab* decision is also cited in Section 2143.01 of the Manual of Patent Examining Procedure.

2. Arguments Concerning Claims 4-6

Independent claims 4, 5 and 6 call for respective combination of elements including a "fuel cell" and a device that supplies fuel droplets. The device is a "thermal drop ejector" in claim 4, a "piezoelectric drop ejector" in claim 5, and a "flextensional drop ejector" in claim 6. The Kindler '594 patent fails to teach or suggest such combinations.

The Kindler '594 patent discloses the use of a boiling/cooling process and various atomizers for producing drops for the fuel cells disclosed therein. [Column 7, lines 8-30.] As noted on page 5 of the Office Action, the Kindler '594 patent does not disclose the use of "thermal," "piezoelectric" and "flextensional" drop ejectors. Nevertheless, the Office Action states that it would have been obvious to substitute any one of the "thermal," "piezoelectric" and "flextensional" drop ejectors for the atomizers disclosed in the Kindler '594 patent. [Office Action at page 6.]

The Office Action appears to base the conclusion of obviousness on the following four assertions: (1) the Kindler '594 patent indicates that "any number of means for forming aerosol may be employed" (column 7, lines 14-15); (2) the Kindler

'594 patent discloses two "means," i.e. a boiling/cooling process and various atomizers; (3) the Kindler '594 patent discloses a number of different atomizers as well as methods of, and reasons for, adjusting the atomization conditions (Office Action at pages 5 and 10); and (4) "thermal," "piezoelectric" and "flextensional" drop ejectors are "functionally equivalent" to an ultrasonic atomizer (Office Action at page 6).

Even assuming that assertions (1), (2) and (3) are accurate, there is nothing in assertions (1), (2) and (3) that even remotely constitutes a "motivation, suggestion or teaching" to employ a "thermal," "piezoelectric" or "flextensional" drop ejector in one of the Kindler fuel cells. At most, assertions (1), (2) and (3) merely indicate that something other than a boiling/cooling process or an atomizer could be employed, that a variety of atomizers exist, and that atomizers can be operated in a variety of ways depending on the desired atomizer output.

Turing to assertion (4), the Office Action ***does not provide any evidence*** whatsoever (e.g. a prior art reference) which indicates, ***in the context of supplying fuel to a fuel cell anode***, or in any other context for that matter, that "thermal," "piezoelectric" and "flextensional" drop ejectors are "functionally equivalent" to an ultrasonic atomizer. To the contrary, and by way of example, the flextensional drop ejector illustrated in Figures 16-18 of the present application may be used to fire drops in a variety of directions. [Page 9, line 29 to page 10, line 11.] The Office Action has not provided any evidence that the boiling/cooling process or atomizers disclosed in the Kindler '594 patent could perform this function, i.e. are "functionally equivalent."

Accordingly, applicant respectfully submits that the Office Action failed to make a *prima facia* case of obviousness with respect to claims 4-6. The rejection of claims 4-6 under 35 U.S.C. § 103 is, therefore, improper and should be reversed.

3. Arguments Concerning Claim 9

Dependent claim 9 depends from independent claim 8. Applicant respectfully submits that the Singh '993 patent fails to remedy the deficiencies in the Kindler '594 patent with respect to independent claim 8 discussed in Section VII-B-4 on pages 18 and 19 of this Brief. As such, claim 9 is patentable for at least the same reasons as

independent claim 8. The rejection of claim 9 under 35 U.S.C. § 103 is, therefore, improper and should be reversed.

4. Arguments Concerning Claim 16

Independent claim 16 calls for a combination of method steps including, *inter alia*, the step of "directing a spray of fuel droplets onto the anode by generating a spray of fuel droplets and blowing the droplets towards the anode ***with a fan***." The Kindler '594 patent fails to teach or suggest such a combination. For example, the Kindler '594 patent does not teach or suggest blowing fuel droplets with a fan. The only fan disclosed in the Kindler '594 patent is used to supply air to a cathode. [Column 5, lines 51-54.]

The Office Action has taken the position that, in view of the teachings of the Pun '382 patent, it would have been obvious to add a fan to one of the fuel cell devices disclosed in the Kindler '594 patent. The Pun '382 patent is directed to "a spray apparatus that produces uniform sized atomized droplets controllable ***from fog size to larger*** for spraying fungicides, bactericides, pesticides, insecticides, plant nutrients and other materials applied to crop, ground, and foliage for agricultural and horticultural benefaction." [Abstract.] Figure 14 is also noteworthy. Nothing in the Pun '382 patent even remotely suggests its teaching are applicable to fuel droplets generally, and fuel cells in particular. In fact, the Pun '382 patent does not include the word "fuel," the word "cell" or the word "anode."

As the Federal Circuit reiterated in *In re Lee*, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002), "a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding.'" [Citations omitted.] The burden of showing obviousness may be satisfied "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." [Id. at 1434, citations omitted.] Here, there is absolutely no reason, other than a hindsight attempt to replicate the claimed combinations, to combine the cited references in the manner proposed in the Office Action.

There is also some case law which indicates that an Examiner "may find a motivation to combine prior art references in the nature of a problem to be solved." *See, e.g., Ruiz v. A.B. Chance Co,* 69 USPQ2d 1686, 1690 (Fed. Cir. 2004). Here, however, the Office Action ***failed to identify a common problem*** that one of skill in the art would associate with both the generation of electricity with fuel cells and the production of "atomized droplets controllable ***from fog size to larger*** for spraying fungicides, bactericides, pesticides, insecticides, plant nutrients and other materials applied to crop, ground, and foliage for agricultural and horticultural benefaction" that could have supported the proposed combination. *Ruiz* at 1691.

Accordingly, applicant respectfully submits that the Office Action has failed to make a *prima facia* case of obviousness with respect to claim 16. The rejection of claim 16 under 35 U.S.C. § 103 is, therefore, improper and should be reversed.

5. Arguments Concerning Claims 86-88

Claims 86-88 depend from independent claim 82 and, accordingly, include each of the elements recited in claim 82. To that end, independent claim 82 calls for a combination of elements comprising, *inter alia*, "a fuel cell including at least one anode defining a surface that receives fuel and a fuel passage adjacent to the anode surface that receives fuel" and "a fuel supply apparatus that directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode surface that receives fuel." Dependent claims 86-88 respectively specify that the fuel supply apparatus is a "thermal drop ejector," a "piezoelectric drop ejector" and a "flextensional drop ejector."

The Kindler '594 patent fails to teach or suggest such combinations. Notwithstanding the fact that the Kindler '594 patent fails to teach or suggest the portions of dependent claims 86-88 that are set forth in independent claim 82 (see Section VII-B-7 on pages 22-24 of this Brief), the Kindler '594 patent also fails to disclose the use of "thermal," "piezoelectric" and "flextensional" drop ejectors. [Office Action at page 5.] Instead, the Kindler '594 patent merely includes a vague statement that "any number of means for forming aerosol may be employed" and, with respect to specifics, discloses the a boiling/cooling process and various atomizers.

The Office Action states that it would have been obvious to substitute any one of the "thermal," "piezoelectric" and "flextensional" drop ejectors for the atomizers disclosed in the Kindler '594 patent. [Office Action at page 6.] The Office Action appears to base the conclusion of obviousness on the following four assertions: (1) the Kindler '594 patent indicates that "any number of means for forming aerosol may be employed" (column 7, lines 14-15); (2) the Kindler '594 patent discloses two "means," i.e. a boiling/cooling process and various atomizers; (3) the Kindler '594 patent discloses a number of different atomizers as well as methods of, and reasons for, adjusting the atomization conditions (Office Action at pages 5 and 10); and (4) "thermal," "piezoelectric" and "flextensional" drop ejectors are "functionally equivalent" to an atomizer (Office Action at page 6).

Even assuming that assertions (1), (2) and (3) are accurate, there is nothing in assertions (1), (2) and (3) that even remotely constitutes a "motivation, suggestion or teaching" to employ a "thermal," "piezoelectric" or "flextensional" drop ejector in one of the Kindler fuel cells. At most, assertions (1), (2) and (3) merely indicate that something other than a boiling/cooling process or an atomizer could be employed, that a variety of atomizers exist, at that atomizers can be operated in a variety of ways depending on the desired atomizer output.

Turing to assertion (4), the Office Action ***does not provide any evidence*** whatsoever (e.g. a prior art reference) which indicates, ***in the context of supplying fuel to a fuel cell anode***, or in any other context for that matter, that "thermal," "piezoelectric" and "flextensional" drop ejectors are "functionally equivalent" to an ultrasonic atomizer. To the contrary, and by way of example, the flextensional drop ejector illustrated in Figures 16-18 of the present application may be used to fire drops in a variety of directions. [Page 9, line 29 to page 10, line 11.] The Office Action has not provided any evidence that the boiling/cooling process or atomizers disclosed in the Kindler '594 patent could perform this function, i.e. are "functionally equivalent."

Accordingly, applicant respectfully submits that the Office Action has failed to make a *prima facia* case of obviousness with respect to claims 86-88 and that the rejection thereof under 35 U.S.C. § 103 is improper and should be reversed.

VIII. CLOSING REMARKS

As applicant has shown above, the objection under 35 U.S.C. § 132 and rejection of claim 83 under 35 U.S.C. § 112 are improper and should be reversed, the rejection of claims 1-3, 7, 8, 11-15, 17, 20, 82, 84, 85 and 89 under 35 U.S.C. § 102 is improper and should be reversed, and the rejections of claims 4-6, 9, 16 and 86-88 under 35 U.S.C. § 103 are improper and should be reversed.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-2025. Should such fees be associated with an extension of time, applicant respectfully requests that this paper be considered a petition therefor.

Respectfully submitted,

8/15/05
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CLAIMS APPENDIX

1. A fuel cell system, comprising:
a fuel cell stack including a plurality of anodes; and
a single fuel supply apparatus that supplies a plurality of fuel droplets to each of the anodes.

2. A fuel cell system as claimed in claim 1, further comprising:
a controller adapted to monitor a rate of fuel consumption at the anodes and to control the fuel supply apparatus to supply droplets at a rate corresponding to the rate of fuel consumption.

3. A fuel cell system as claimed in claim 1, wherein the anodes face one another and define a fuel passage therebetween, and the fuel supply apparatus directs the fuel droplets into the fuel passage.

4. A fuel cell system, comprising:
a fuel cell including at least one anode; and
a thermal drop ejector that supplies a plurality of fuel droplets to the at least one anode.

5. A fuel cell system, comprising:
a fuel cell including at least one anode; and
a piezoelectric drop ejector that supplies a plurality of fuel droplets to the at least one anode.

6. A fuel cell system, comprising:
a fuel cell including at least one anode; and
a flextensional drop ejector that supplies a plurality of fuel droplets to the at least one anode.

7. A fuel cell system as claimed in claim 1, wherein the single fuel supply apparatus comprises an ultrasonic atomizer.

8. A fuel cell system, comprising:
a fuel cell stack including at least one anode pair arranged such that the anodes within the anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair; and
fuel supply means for supplying a plurality of droplets to the fuel passage between the at least one anode pair.

9. A fuel cell system as claimed in claim 8, further comprising:
storage means for storing energy generated with fuel that is on the anodes when the system is shut down.

11. A fuel cell system, comprising:

a fuel cell stack including

a plurality of anodes pairs arranged such that the anodes within each anode pair face one another and define a fuel passage therebetween that extends from one anode in the pair to the other anode in the pair, and

a plurality of cathodes; and

a fuel reservoir;

a fuel supply apparatus that draws fuel from the fuel reservoir and supplies a plurality of fuel droplets to the fuel passages.

12. A fuel cell system as claimed in claim 11, wherein the fuel supply apparatus comprises at least one of a thermal drop ejector, a piezoelectric drop ejector, a flextensional drop ejector, and an ultrasonic atomizer.

13. A fuel cell system as claimed in claim 11, further comprising:

a controller adapted to monitor a rate of fuel consumption at the anodes and to control the fuel supply apparatus to supply droplets at a rate corresponding to the rate of fuel consumption.

14. A method of operating a fuel cell stack comprising the steps of:

directing a spray of fuel droplets into a fuel passage that extends from a first anode in an anode pair to a second anode in the anode pair such that at least some of the droplets come to rest on the first anode and at least some of the droplets come to rest on the second anode; and

consuming the fuel at the anodes.

15. A method as claimed in claim 14, wherein the step of directing a spray of fuel droplets into a fuel passage comprises creating the spray of fuel droplets with at least one of a thermal drop ejector, a piezoelectric drop ejector, a flextensional drop ejector, and an ultrasonic atomizer.

16. A method of operating a fuel cell having an anode, the method comprising the steps of:

directing a spray of fuel droplets onto the anode by generating a spray of fuel droplets and blowing the droplets towards the anode with a fan; and

consuming the fuel at the anode.

17. A method as claimed in claim 14, wherein the step of directing a spray of fuel droplets into a fuel passage comprises directing a spray of fuel droplets into the fuel passage at a rate corresponding to a rate at which the fuel is being consumed at the anodes.

20. A fuel supply system for use with a fuel cell including an anode, comprising:

a fuel reservoir that stores fuel;

fuel supply means, operably connected to the fuel reservoir, for supplying a plurality of droplets to the at least one anode; and

a controller adapted to monitor a rate of fuel consumption at the anode and to control the fuel supply means to supply droplets at a rate that results in a fuel layer being maintained on the anode.

82. A fuel cell system, comprising:

a fuel cell including at least one anode defining a surface that receives fuel and a fuel passage adjacent to the anode surface that receives fuel; and

a fuel supply apparatus that directs a plurality of fuel droplets into the fuel passage in a direction that is non-perpendicular to the anode surface that receives fuel.

83. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus directs a plurality of droplets into the fuel passage in a direction that is substantially parallel to the anode surface that receives fuel.

84. A fuel cell system as claimed in claim 82, further comprising:

a controller adapted to monitor a rate of fuel consumption at the at least one anode and to control the fuel supply apparatus to supply droplets at a rate corresponding to the rate of fuel consumption.

85. A fuel cell system as claimed in claim 82, wherein the fuel cell comprises at least one anode pair, the anodes within the at least one anode pair face one another and define the fuel path therebetween, and the fuel supply apparatus directs the fuel droplets into the fuel path.

86. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus comprises a thermal drop ejector.

87. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus comprises a piezoelectric drop ejector.

88. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus comprises a flextensional drop ejector.

89. A fuel cell system as claimed in claim 82, wherein the fuel supply apparatus comprises an ultrasonic atomizer.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.